

DOCUMENT RESUME

ED 320 532

IR 014 435

AUTHOR Jermanovich, Trudy
TITLE Using Computer Technology To Enhance Middle School Science.
PUB DATE 89
NOTE 132p.; Ed.D. Practicum, Nova University.
PUB TYPE Dissertations/Theses - Practicum Papers (043) --
Guides - Non-Classroom Use (055) -- Tests/Evaluation
Instruments (160)

EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; *Computer Managed
Instruction; *Computer Networks; Computer Software;
Junior High Schools; *Laboratories; Microcomputers;
Middle Schools; Optical Disks; *Science Instruction;
*Student Evaluation

ABSTRACT

This practicum was designed to encourage middle school science teachers to utilize computer technology as an enhancement in order to provide students with an additional means of addressing their basic skills areas. The primary goals were to provide information on the ease of utilization of appropriate computer-managed software through networking and to formulate a guide to using this type of software with students. In addition, inservice workshops were provided on the use of laser disc technology. A networking environment was established with a schedule providing access for a large number of students in a computer-assisted instruction (CAI) laboratory situation. Teachers were able to inform a laboratory manager of the skills that students would use. The computer-managed instruction (CMI) system kept track of students' scores, and printouts were provided to teachers. A guide on how best to utilize this resource was developed. The results of the practicum were positive, with students, teachers, and parents indicating the success of the use of networked CAI through surveys, increased test scores, and completion of student projects. Laser discs proved more difficult to learn, and use of this technology was limited. Appendixes include survey instruments, project data, a sample printout of student scores as recorded in the computer laboratory, and a handbook for teachers on using CAI/CMI laboratories. (11 references) (GL)

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USING COMPUTER TECHNOLOGY TO
ENHANCE MIDDLE SCHOOL SCIENCE

by

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**Using Computer Technology to
Enhance Middle School Science**

by

Trudy Jermanovich

Cluster 25B

**A Practicum I Report Presented to the Ed.D. Program
in Early and Middle Childhood
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Education**

NOVA UNIVERSITY

1989

IR014435

PRACTICUM APPROVAL SHEET

This practicum took place as described.

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Approved:

Dec. 31, 1989
Date of Final Approval of
Report

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Acknowledgment

It is with sincere appreciation that this author thanks the many people who have helped in the completion of this practicum project. Special thanks goes to my husband, Miles, for his patience, support, and encouragement.

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ABSTRACT

Using Computer Technology to Enhance Middle School Science.
Jermanovich, Trudy, 1989: Practicum Report, Nova University,
Ed.D. Program in Early and Middle Childhood.Descriptors:
Computers/ Computer Education/ Computer Assisted Instruction/
Computer Managed Instruction/ Computer Networking/Laser Disc
Instruction/ Middle School Education/ Science/ Curriculum
Enhancements/ Technology

This practicum was designed to encourage middle school science teachers to utilize computer technology as an enhancement in order to provide students with an additional means of addressing their basic skill areas. The primary goal was to provide information on ease of utilization of appropriate computer managed software through networking, and to formulate a guide on how to use this type of software with students. Teachers of science were targeted, but the middle school subject areas of math, English, reading were also involved in the project. A limited number of teachers used laser disc technology as well.

The writer gathered information from several areas on the success of networking in the subject areas listed above. A local needs assessment showed that teachers wished to use computer technology more productively. A networking environment was established with a schedule providing access for a large number of students in a CAI lab situation. Teachers were able to inform a Lab Manager of the skills which students would use, and then the computer managed instruction system kept track of student's scores, and print-outs were provided to teachers. A guide on how to best utilize this resource was developed and is included in the practicum report's appendices.

The results of the practicum were positive with students, teachers, and parents indicating the success of the use of networked CAI through surveys, increased test scores, and completion of student projects. Laser discs proved more difficult to learn, and use of this technology was limited. Results may be of interest to those interested in the incorporation of computers into the curriculum.

Chapter I

INTRODUCTION

Description of Work Setting and Community

The focus of this practicum report was within a middle school, grades 6, 7, and 8, situated in the southeastern section of the country. The school might be considered an inner-city school, as it is located in a large metropolitan area, however, the student population included a cross-section of all types of socioeconomic groups. Some students came from homes that were located near the coastline and were valued in the \$200,000. to \$800,000. range. Others came from a subsidized housing area, with a few homes still lacking indoor plumbing. The ethnic make-up of the school was 41% Black, 52% Caucasian, and 7% Hispanic and Asian. Approximately 46% of the students were eligible for Chapter I classes in math, English, and reading. The school also had classes with

students in specific learning disabilities (SLD), English for speakers of other languages (ESOL), emotionally handicapped, educable mentally retarded, visually and physically handicapped. On the other hand there were students who were classified as gifted, and a large percentage of accelerated classes.

Meeting the needs of a variety of students continues to be a challenge to schools throughout the nation, and this school was no exception. The primary goal of the present program has been to meet the individual needs of all students at the school. One of the avenues chosen to address individual student differences was to provide computer assisted instruction. Traditionally, computers have been utilized in a variety of interesting ways at this school. Initially, before other schools had any computers, this school took its own funds to purchase a small number of computers and began teaching computer literacy. As more computers were provided, several labs were set up.

The success of the computer programs has been assessed in a variety of ways. The popularity of computer classes was evident in the choices made by students and parents each year. The students and teachers have received a number of awards related to computer use. Some of these were from the county-wide computer, science and social studies fairs; the state science fair; the American Computer Science League (national competition); and the Apple Computer Club (both teachers and students). Finally, the school has been chosen as a pilot site for implementing several technology projects. Even though the actual school building is 32 years old and has many problems of deterioration, there has been a continued commitment to the use of this new resource. Still, there are many ways which technology might be utilized more effectively at the school.

Writer's Work Setting and Role

The writer has been a full time science and computer teacher, as well as middle school and computer coordinator. She has had extensive training and experience in curriculum development in the areas of science, health, and computer education, as well as in the implementation of computer related projects. In the past she has had materials published and utilized by the large county level school districts in the area. Her experience includes over twenty years of teaching students from the first grade level through adults. For the past several years she has worked with community members and specialized companies to implement the use of technology within schools. She has received grant monies totaling over \$100,000 for herself and for the school district and was selected as Florida's Computer Teacher of the Year in 1989.

Chapter II

STUDY OF THE PROBLEM

Problem Description

Although this middle school has been considered a "Leader in Technology", many of the needs of the students at the school have not yet been addressed. Even though a large number of computers have been available in the past, many teachers are apprehensive about using technology with their students. The reasons for these apprehensions were varied, but the most commonly expressed included not having the expertise to feel comfortable with computers in the classroom setting, not having time to preview the available software, not having enough programs for students to use in a reasonably short time, not having sufficient time to organize the use of the technology, difficulty in keeping track of what students use and verification of the effectiveness of the use of the technology. Students, parents, and community leaders

have also expressed the concern that students were not utilizing technology as a tool in the learning process.

Briefly stated then, the problem was that teachers and students needed to have technology available in an organized, easy-to-use manner to reduce insecurity in teachers as well as facilitate improvement of student test scores and student produced projects.

Problem Documentation

The problem of utilizing technology within the learning process is one which was addressed by a county level committee. This committee described major improvements needed throughout the school system and set up a time line for implementation which was agreed upon and published for future reference. It was recommended through a needs assessment process that use of computer technology be increased in order to better prepare the students of today for the world of tomorrow. A coalition of business, education, and parents produced a comprehensive educational plan for

1986-1991 (Staff, 1986). One proposal was to explore using Computer Managed Instruction (CMI), integrating Computer Assisted Instruction (CAI) within the total curriculum as well as providing for teacher training (see Appendix A).

Within the school setting teachers have been interviewed regarding what they would need to facilitate the use of computer technology in various subject areas. Finally, the teachers of math and reading who were able to use existing computer technology were surveyed as to how beneficial they found present usage. Regarding how much the students enjoyed using the lab, how teachers felt the students benefited from using CAI, and how teachers were able to incorporate topics learned by CAI into the classroom, there was an affirmative 100%. Over 85% of the other teachers who were unable to use the available resources expressed the desire to use the technology in the future (see Appendix B). Parents and students expressed their desire for more access to using computer technology by requesting after

school classes, and by their consistent interest shown in scheduled computer classes. Verbal requests were also made for computers to be made available before school officially started and during the lunch break. This support shows the willingness of the entire community to provide computer technology to students as a resource in learning basic skills and as a tool for independent study.

In 1988, a further survey of teachers was taken throughout the county which reinforced the need for the use of CMI in the many subject areas. Teachers responded with over 90% agreement that time spent was productive for students, that there was effective use of computers in a CAI Lab, and that even after several months, students still enjoyed using CAI in a lab setting. It was also felt that there should be continual up-dating of teachers' skills by increased teacher inservicing. This was shown by a somewhat lesser amount of teachers feeling that curriculum was appropriate for various students (75%) and that the curriculum

corresponds to classroom activities (83%). The teachers wanted to have someone available as a resource person (95%). Only 75% of the teachers felt that they had been given enough information about the lab. This information shows that teachers felt that CAI/CMI is a valuable tool to use with students, but that they need to have someone available as a resource and they need increased inservice activities (see Appendix C). A sample of comments regarding some reasons for more inservice is also included. Within the individual school site, teachers were asked about their needs regarding the use of technology. A survey (see Appendix D) was taken which indicated that there was a need for more inservice, and more direct involvement of someone to coordinate the use of technology within the school. Teachers did express the desire to use the technology which was available, but they felt very constrained about the time needed to organize for it's use.

Causative Analysis

The situation at this middle school had arisen because teachers, parents, and students wanted to have more technology available than might be available in other schools. There was a striving for excellence through utilization of existing resources which actually led to the problem. Many teachers who are within the school did not feel confident about using any type of technology, but were especially hesitant about using computers. They also felt constrained by lack of time to evaluate, organize and coordinate the use of computer time. They wanted to be assured that this type of class time would benefit the students and not simply be considered a "frill".

Parents, community members, and finally, students wanted there to be as much exposure to computer technology as possible. They have expressed the desire that the school allow students to use the computer as a tool in the learning process, and were almost demanding the additional time for

this type of exploration. These persons seemed say in unison, "This is a need for the future which students can be using today!" All indications seemed to agree with these requests, that computer technology should be made available in new and innovative ways. Unfortunately, the county school system has not provided additional funds for development of ways to implement the use of technology, and so it was important to keep costs down while striving to provide these services to teachers and students.

Relationship of the Problem to the Literature

During the review of the research, it was necessary for the reader to have some basic terminology which was often abbreviated in use. There were three major types of terms which have subtle differences between them, and their meaning may vary from writer to writer. Generally, however, the descriptions given below should suffice.

Computer Assisted Instruction (CAI) may refer to any

type of software program which imparts knowledge to the student. Some people refer to CAI with the meaning being any computer interaction with students. Most of this paper will use this all-encompassing term.

Computer Managed Instruction (CMI) can refer to any type of computer interface which helps the teacher track the progress of the students. This may be through tests which are scanned and analyzed, or it may refer to complete organizational programs which test, refer the student to the appropriate software program, retest the student and then remediate or send them to another objective. CMI may be all or a part of the above, and often is flexible enough that the teacher has control of the objectives which the students address on the computer.

Computer Assisted Learning (CAL) may be used to mean either CAI or CMI, or may even refer to a more general use of the computer for individual studies by the student. Computer Assisted Learning may also be referred to as

Computer Based Instruction (CBI). With these acronyms in mind, we can continue.

In "Search of the Literature", by Denyse Forman (1982), we are provided with a complete compilation of studies related to computer managed instruction (CMI) and computer assisted instruction (CAI). Even though this study was conducted several years ago, many of her findings can be beneficial in verifying the need for using computers in schools of today. The results which are relevant to this practicum include consideration of cost effectiveness of systems, changing the knowledge base and attitudes of all teachers regarding use of computers, and the importance of continued review of materials to be used with technological advances. It was also shown that there can be a dramatic increase in student skills, attitudes toward school, and positive responses by parents when computers are used by schools in this fashion.

Through reviewing what works with implementing

computer use in the schools, Robert Aiken (1981) has postulated that it is necessary to make computer based education productive in schools. He summarizes what he believes is the Golden Rule of CBE-"Teach unto others as you would like to be taught". (p. 58) The successful use of computers means that you would: select reliable hardware, consider the people-machine interface, guarantee good maintenance, select good courseware, choose appropriate software, make computers accessible outside class, adequately train teachers, provide administrative support for teachers, elicit community and parent support, and motivate students properly. The ultimate goal is to instill in students the will to go beyond what is being taught and to give them the desire to continue learning.

Gerald Bracey, Ph.D., (1987) has done a recent survey of research which was concerned with computer assisted instruction (CAI). He was impressed with the consistency of positive results when using CAI. The correlations indicate

that 85 to 90 percent of the studies show positive results when using computer assisted instruction. Since this was a review which included all age levels, there was some evidence that younger students seemed to benefit more than college age students. A variety of reasons were cited including the need for more sophisticated programming techniques, and general expertise when involving higher level subject areas. The indication was that students in elementary and middle schools can show substantial gains in test scores as well as in using computers for future life skills.

Another important educator involved with computers was Seymour Papert, the developer of a computer language called LOGO. Papert was a believer in the ability of the child as a creator of his or her individual learning environment. In Mindstorms, Papert (1980) stated:

"The computer is the Proteus of machines. Its essence is its universality, its power to simulate. Because it can take on a thousand forms and can serve a thousand

functions, it can appeal to a thousand tastes." (p.viii)

The entire book celebrates the ability of the child to interact in the thinking process and develop a new type of thinking which has not been possible before. Referring to Piaget and Montessori in relationship to the use of the computer as a tool for children to develop their own style of thinking, Papert believes that access to computers for all children in our society is essential. As he so aptly phrased it, "Microworlds are incubators for knowledge." (p.120)

In order to better provide the adults of tomorrow with the knowledge, skill, and comfort level they will need in coping with this new revolution, it is imperative that schools provide access to technology now. For this to occur, it is the responsibility for schools to prepare teachers to deal with this emerging technology. Only then will they achieve a comfort level which will allow them to use computers and peripherals for the benefit of all students within a school setting.

In summary, the research has shown that use of computer technology can be beneficial within a school setting. This can be verified by studies which are available from up to twenty years ago to the present. Even though there has been an increase in achievement shown with use of technology such as computer assisted instruction, there are still many problems associated with the use of all types of technology. Through improving teacher and student access to technology in an organized and consistent manner, increased use of this resource should be confirmed. Additionally, a more positive attitude toward the use of technology should be expressed by teachers, and students should show increased achievement rates as well as a willingness to use technology as a tool for accomplishing independent goals.

Chapter III

ANTICIPATED OUTCOMES AND EVALUATION INSTRUMENTS

Statement of General Goals

The major focus of this practicum was to provide teachers with knowledge and help so that they would become more confident in the use of technology. Specifically, it was necessary to provide teachers with an organized, coordinated set-up so that they were able to view the use of technology much as they previously viewed an overhead projector or television and video cassette recorder. With this goal having been achieved, both the teachers and students should be better able to utilize this resource to its fullest extent. The ultimate goals were to reduce insecurity for the use of technology and thereby increase usage and student achievement.

Behavioral Expectations

In order that students be given access to the use of technology, a general overall change in the system was needed. The teachers were the key, and needed to be convinced that there was an easily workable solution to including the use of technology within their plans for students. Through this effort, students were encouraged to use computer technology more. Most teachers within the school environment have become better able to cope with the emerging technological revolution.

The objectives of this project were two fold. The use of technology was increased by students and teachers in an unobtrusive manner that allowed for enhancement of the learning process. Although science teachers were targeted, there were other teachers who wished to utilize these resources, and they were also included in the project whenever possible.

First, middle school teachers were to demonstrate the

ability to use and to evaluate the success of computer technology with students. Secondly, students were to show an increase in the use of computer technology through calendar logs kept in the computer lab, and projects produced. Through this increased use, student achievement in the targeted area of science was to increase.

Evaluation Instruments

Through surveys and logs, five science teachers and approximately ten other teachers have shown an increased confidence for using computer technology and an increase in their ability to evaluate the technology available. The writer was also asked to carry-out a similar survey with 68 teachers in other middle schools, and the results of the combined surveys showed that the use of technology has been made available for a variety of subject areas.

The targeted classes of science students were specifically tested on increased knowledge gained on a county Minimum Basic Skill. This was recorded via the computer

management system, so that the teachers would not have extra paperwork.

Further indication of the need for technology use was shown through surveys given to approximately forty science students and four parents who provided written comments. Again, over fifty percent of the respondents have shown they felt that there is a need for the use of technology.

Science teachers who participated in the project (no less than four) were surveyed to see if they felt more confident about using technology within their classrooms. A more general survey was used to further evaluate the success of this type of trial setting with approximately 68 teachers from a variety of subject areas around the county and 26 teachers within the school setting. These teachers have also shown a positive attitude toward computer use. Well over 50% of the teachers have shown their increased confidence from positive responses on the survey and from their students actually using the technology more. This evaluation involved

approximately 68 teachers, five of whom were in the field of science.

In addition, through this increased use, middle school students have shown an increase in their achievements by using technology as a tool. Students and their parents have indicated that computer technology should be used in schools. Students were monitored through scheduled classes and a log-in system which showed that they were using computer technology more.

In order to compare student progress, there was a random selection taken of over 150 science students' scores which showed that they were making gains in County Minimum Basic Skills (MBS) after using computer assisted instruction programs. This was accomplished by comparing programs using the skills on the computer with the indication of success by the teacher regarding this skill and student improvements in time needed to pass a skill. Approximately 150 students were monitored.

All subject area teachers also indicated in their written comments that they saw an increased interest by students in achieving the minimum basic skills through the use of the computers. There were also examples of projects which students completed using the technology which was made available for them. Students indicated their success by:

1.) an increased use of technology by time on schedules and logs, 2.) a decrease in the time needed to pass Minimum Basic Skills after using computer technology, 3.) actually producing science projects using technology as a tool, and 4.) by indicating on their own survey that the use of technology was important to them. In addition, a small number of parents were also surveyed and interviewed, and showed a positive attitude toward having technology used in a school setting. Well over 50% of these responses have shown that all who were questioned felt that the use of technology was important to have in schools. These teachers, students and parents positive attitudinal response was an indication of the

need for technology use for all students.

The types of surveys which were used for teachers were two fold. One was developed for a county evaluation of the effectiveness of using networked computer assisted or managed instruction at the middle school level. This instrument was needed to verify that teachers had become able to use existing computers in a networked, managed environment and they had begun to use computers as a new tool for teaching. This survey consisted of fifteen items which could provide a broad base of information, and contained a scale which consisted of five parts: Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree.

The results were obtained by analyzing information from teachers of various subject areas for each of the fifteen questions. Although there were approximately fifteen teachers who responded from our school, the information from the other middle schools gives a more broad based assessment. These figures were analyzed using a computer

generated statistical analysis program available in the county.

The survey also contained an area for written comments which asked the teachers to relate what they liked best and least about using the lab, and to write about any other interesting experiences. This information could be classified by type of response, and so was analyzed in a numerical fashion (see Appendix E).

A second shorter survey was given only at the project school site, and was used as a culminating assessment for the year. (see Appendix F) It contained four items which were utilized for further evidence of the success of this program. The target school for this project was the only one of the five middle schools who was using a managed computer networked environment within the subject area of science. This additional time within the CAI Lab was available for five science teachers with their students.

The written comments obtained were analyzed separately and then compared to those of the entire sample

of respondents. These comments provided anecdotal experiences which might prove beneficial in defending the use of computer assisted instruction. Twenty-six teachers responded to this survey within the pilot school.

Although the bulk of the information for this paper could be derived from the surveys alone, there were also a variety of notes kept in calendar logs. These evaluation procedures provided an estimate of students using the computer equipment, the number of teachers scheduled into the lab, and the number of teachers utilizing computer laser disk technology. These logs also provided information on any unusual occurrences and contained some indication of the types of programs that the students chose to use by themselves.

Random samples were taken of the students using software programs that correlated with the seventh grade Minimum Basic Skills required in science. These results were presented in print-outs obtained from the computer, and

teacher verification of the skill passed after using computer assisted instruction. Some of these students were also asked to respond to a short questionnaire which indicated how they felt about using the computer as a resource for learning (see Appendix G).

Many students who utilized computers within the school to complete projects were tracked and their success was shown by their accomplishments being acknowledged on the final list for awards at the end of the year. The types of activities winning awards were in many categories. Four parents were asked to respond verbally, and a few also included positive comments about the computer program on questionnaires sent home for other purposes.

An indication of parental support for the program was provided by the PTSA through a monetary contribution of \$1200 to expand the project. It was requested by the principal that this be the extent of questioning for parents, and that all surveys be kept at a minimum.

Chapter IV

SOLUTION STRATEGY

Discussion and Evaluation of Solution

Dr. Cecil McDermott (1987) has collected research over the past 24 years on CAI and CMI. Recently, he reviewed 73 research reports from 1962-1985 and found some common threads suggested from the literature. CAI can be very effective when specific objectives are to be met as in basic skills areas. There is a significant time savings, and students have retention rates which are at least as good or better than conventional instruction alone. The students have a positive attitude toward using CAI and this transfers to a positive attitude toward use of computers in general. Finally, he has concluded that CAI that is combined with CMI that monitors student performance enhances the effectiveness by as much as thirty percent.

One of the major components which will be utilized in solving the problem addressed in this paper is through the use of two types of new computer related technology. The major focus of these is "networking". A computer network is a way to implement CAI and CMI with a series of microcomputers which are connected together and share a common source of software through a large storage device called a hard disk drive. This is not a new development, as it has been used in the business community for several years. Interactive video, also known as laser disc technology, is much like the compact discs which are popular for music. For education there are programs which can be integrated with the computer and teachers can organize interesting sequences which enhance their teaching abilities through pictures, movies, or simulations. These programs are especially beneficial in science and math classrooms, or the students can use this resource in independent explorations of their own. This technology may ultimately be merged with CAI-CMI to

have a more exciting presentation.

As if predicting the future, Evan Birkhead (1986), forecasted that Local-Area Networks (LANs) would be one of the most important technological advances available to educators. He discusses the most reasonable way to utilize computers by sharing the programs, thus eliminating one of the most problematic aspects of using technology with students. He emphasizes the reduced cost and the time savings attached with eliminating the need for a "floppy disk" for each station. Networking technology takes away many of the organizational problems which most teachers associate with computer usage.

Three recent articles also explain about the use of networked microcomputers. Lehrer, (1988); McCarthy, (1988); and Solomon, (1987); all address how linking microcomputers through a network can be beneficial in freeing up teachers and students for the process of learning.

The aim is to make computers a tool for the use of the educator and those being educated. Using a LAN allows this to occur in a reasonably short period of time and with a minimum of expense to the school system. Solomon's article, "Computers, Networks, and Desegregation at San Jose High Academy", describes how implementing technology has helped the students at the school have access to computers in many subject areas. One of these connects six science classrooms with six computers each. The aim of providing this technology is to "create an academically oriented student body with high standards and to reinforce skills for any student who is weak in any area". (p. 14)

One of the newest uses of the computer is by integrating with a laser disc, creating interactive video. Joanne Troutner (1987), summarizes the three levels of interactive video: Level 1-using only a simplistic player for a product much like a VCR, Level 2-the player contains a computer chip which allows branching for instructional uses,

and Level 3-a fully interactive machine which allows attachment to a microcomputer for complex branching and record keeping. The advantage of the videodisc technology over conventional VCRs is mostly speed and precision.

Videodiscs can use random access while VCRs must access in a linear fashion. One of the most relevant statements in the article is:

"Implementing the use of interactive video in a school system requires time, training and support staff. Any technology effort is doomed to mediocrity or failure if a commitment to staff training is not made."

(p. 2)

The subject areas which she has found the most beneficial and the most prevalent software are: first, science; second, math; third, economics; and fourth, art. She also reviews some of the programs which are already in use throughout the country. One study sponsored by the Tennessee Valley Authority showed significant gains for videodisc students in

math. Another interesting study involved hearing-impaired students which utilizes both networking and laserdisc technology.

Technology is often available in many forms throughout a school system. Teachers are told to feel free to use the computers and software and studies show that they are willing to try. A series of problems emerge as the use of technology increases. There is a cost problem which arises from not enough computers, but more often, the real problem becomes not enough time to use software, and not enough software. Teachers are encouraged to take course work on how to use the computer with students, but these courses are often held at remote sites which have little correlation with the actual work place. Next a teacher looks for an adequate supply of software programs within the school which can be used as an extension of their particular subject area, and again they become frustrated. Finally, the actual use of some types of programs are difficult. The teacher often becomes so

frustrated that they see no need for this new resource. As was indicated time and again in the literature reviewed, the teacher inservice component of a program is of paramount importance in the success of the use of any type of technology. At the same time, educators and community members also see the need for preparing the youth of today to adapt easily to the ever expanding information age. A way must be found which can facilitate the use of this technology for all students.

From the articles researched, the terminology of "networking" came up consistently as one means of streamlining the use of computers. The use of a hard disk drive with networking helped solve the problem of massive amounts of floppy disks to be purchased, cataloged, correlated, and then distributed and collected with each class period. Along with this, laser disc technology has emerged as a new form of mass storage which may be combined with networking or used independently. Both of these new forms

of technology helped solve the problems found by teachers in using computers, but not without someone who was still responsible for the organization and delivery of these systems. It was also found that a person was needed for whom others could depend upon to first organize the key components, keep the system going, and simply provide the shoulder to lean on when necessary. The school needed an on-site expert in of all aspects of using computer technology. This was the key to success when providing availability of this resource to students and teachers.

Others have tried in the past to find ways to provide individual classrooms with computers, but always the same problems recurred. You still needed the money to provide the software, and with individual floppy disks, you were dealing with rather fragile resources which could easily be destroyed. There was also difficulty in providing the time for all students to be involved in working with the computers. By implementing a network solution, there was increased

access time provided and the worry about the destruction of software was reduced in the process. You also have a much easier task of actually using the technology once it is networked, so essentially the teacher planned what she or he would like to use or the objective they would like to address, and then they brought their students to the lab. The students were able to immediately find the use of the computer technology within their grasp, and it was often difficult to stop them. Essentially, the teacher was along for the ride and found that in many cases their role had become one of mentor and co-problem solver with the students.

Description of Selected Solution

In order to help teachers, and through them also help students become more comfortable with using computer technology, it was necessary to simplify the process. By this simplification, many of the concerns of teachers were addressed. Although it might appear that it was easier to use

the technology available, actually a complex set of developments had to occur.

This organization of these steps included the setting up of a networking environment with appropriate software, providing proper training of teachers on how to use these resources, and finally monitoring the actual use of technology. A similar plan needed to be formulated to provide access to laser disc players and science software.

The ultimate goal of this project was to allow students the increased access for technology. In order to accomplish this goal teachers needed to first feel comfortable enough to at least ask questions about how they might use these resources. A carefully devised plan was needed to entice teachers to use technology more.

Report Of Action Taken

The first step was to organize the resources and create easy access to both a lab and classroom computers for teachers and students. The key to this ease of use was through the implementation of "networking" the computers together. Because of a recent grant received by this writer, this networking had already been done to some extent at this school site. The expansion of this networking to increase the use by other teachers was the focus of this project. By applying networking principles, several computers were linked together and shared the same software through their attachment to a single hard disk drive. This allowed teachers in many subject areas to use the computers easily.

Through special networking software, called computer managed instruction, it was also possible to provide some type of printed data for teachers to use in grading students. Once this was accomplished, then making teachers aware of how to use this new resource was imperative. This was done

by providing continuous inservice training for those concerned, and then being available to provide back-up for teachers if problems occur.

During the inservicing of teachers, there were correlations of curriculum materials available to help improve the process of using networked computers. It also became necessary to develop a guide for teachers to follow as they prepared for and came into the lab. This was done with great care, and was reviewed and edited by teachers and the lab manager. Teachers had expressed a need for this written resource which could be kept at hand when they had questions about the use of networked computer assisted instruction. A handbook was written for teachers who would be using the CAI/CMI Lab.

A generalized report on the use of CAI/CMI was also produced by this writer for the local union organization. Other staff members such as the principal and assistant principals found the teacher's guide and report helpful in

explaining the use of computers to other administrators at district and state meetings.

A short inservice was also provided on the use of laser disc technology. As teachers became more confident, some began to use technology in their classrooms, and not just in the safety of the lab setting. They were also more willing to allow students to leave their class to come individually into the lab to use the computers as a technological resource when completing projects.

Schedules which showed the use of the computers, both in classrooms and in the lab, were kept to document how this technology was used. In addition, there were some remote areas which were set up so that teachers or students could use the networked software within their classrooms or within the library.

Information sheets on correlation of minimum basic skills were made available in the subject areas of math, reading, and science. These correlations provided a reduction

in paper-work for the teachers who are using the CAI Lab with students.

As a lab coordinator, it was the writer's responsibility to be available to answer questions about the use of technology, and to increase access to the lab for selected students when space was available. This also included supervision of the lab manager, scheduling of classes, many hours of time adding new software to the system, contact with the companies involved in providing hardware and software, and generally being available when needed.

The use of laser disc technology was more difficult to implement because a lab situation could not be provided. The steps involved analyzing the laser disc software which was available for science and targeting some specific areas where it might be used. The physical and earth sciences had programs available and the appropriate teachers were given inservices on the use of this technology. These programs would be used within the regular classroom setting.

The responses of the teachers, students, and a few parents were collected to analyze the effectiveness of the use of computer technology. An emphasis was placed on the comments made by the teachers, and the expansion of this resource into the area of science education. Students' schedules, scores and projects provided data on the use and availability of the lab. Results were obtained from surveys, scores, and any other information which was collected and a final report was completed.

Chapter V

RESULTS, CONCLUSIONS AND RECOMMENDATIONS

Results

The overall goal of this practicum was to provide teachers with knowledge and help so that they would become more confident in the use of technology. The information collected during this project indicates that this has been achieved.

Through surveys and schedules it has been shown that science teachers and others who were exposed to computer technology have increased using this resource now and expect to continue to want to have computers available to them in the future. Two surveys were taken in order to better verify how teachers felt about using Computer Assisted or Managed Instruction in a networked environment.

The first survey contained a comprehensive analysis of teachers throughout the county that were involved in similar use of CAI/CMI within their respective middle schools (see Appendix E). This document included teachers who were participating in this project. The only responses by science teachers came from teachers involved in this project, as other schools were not using CAI in this subject area.

Table 1 summarized responses from each of the subject areas queried. It indicated a strong degree of support for the use of Computer Assisted Instruction by teachers in middle schools. The few science teachers that had CAI resources available to them felt that the use of computers should be expanded to include this subject area. Many subject areas had software which was most productive when used with low-achieving students, however, this was not the case in the area of science. In fact, the software which was available seemed to be most appropriate when used with regular and advanced science students.

Table 1
NETWORKING RESULTS
Middle Schools
CAI/CMI

(Results are represented in percent of respondents for each subject area.)

KEY		SA=Strongly Agree	A=Agree				
U=Undecided	D=Disagree	SD=Strongly Disagree					
		SA	A	U	D	SD	
1. Using networked CAI Lab is beneficial for students.							
Respondents=	11	English	64	27	9	0	0
	19	Math	63	32	5	0	0
	19	Reading	69	31	0	0	0
	5	Science	100	0	0	0	0
	14	ESE	79	21	0	0	0
2. The print-outs provided are of help to me.							
Respondents=	11	English	73	9	18	0	0
	19	Math	63	32	5	0	0
	19	Reading	54	38	0	0	8
	5	Science	80	20	0	0	0
	14	ESE	79	21	0	0	0
3. The time spent in the lab was productive for students.							
Respondents=	11	English	73	18	9	0	0
	19	Math	58	42	0	0	0
	19	Reading	62	38	0	0	0
	5	Science	100	0	0	0	0
	14	ESE	79	21	0	0	0
4. Computer curriculum is appropriate to use in my subject/grade.							
Respondents=	11	English	55	45	0	0	0
	19	Math	61	39	0	0	0
	19	Reading	61	39	0	0	0
	5	Science	100	0	0	0	0
	14	ESE	79	14	0	7	0
5. Curriculum is appropriate to use with low-achieving students.							
Respondents=	11	English	64	36	0	0	0
	19	Math	63	37	0	0	0
	19	Reading	62	38	0	0	0
	5	Science	60	20	0	20	0
	14	ESE	72	7	7	14	0

(Table Continues)

(Table Continues)

Table 1- (Continued)

		SA	A	U	D	SD	
6. Curriculum is appropriate to use with regular students.							
Respondents=	11	English	63	12	0	25	0
	19	Math	47	47	0	6	0
	19	Reading	73	18	9	0	0
	5	Science	80	20	0	0	0
	14	ESE	50	25	17	0	8
7. Curriculum is appropriate to use with high-achieving students.							
Respondents=	11	English	63	12	0	25	0
	19	Math	33	20	14	33	0
	19	Reading	44	0	45	11	0
	5	Science	80	20	0	0	0
	14	ESE	33	25	17	17	8
8. Even after several months, students enjoy coming to lab.							
Respondents=	11	English	82	18	0	0	0
	19	Math	47	53	0	0	0
	19	Reading	77	23	0	0	0
	5	Science	80	20	0	0	0
	14	ESE	64	22	7	7	0
9. There has been a correlation between curriculum & classroom.							
Respondents=	11	English	55	36	9	0	0
	19	Math	42	32	16	10	0
	19	Reading	54	38	0	8	0
	5	Science	100	0	0	0	0
	14	ESE	64	29	0	7	0
10. From reports, I can tell that students have shown progress.							
Respondents=	11	English	36	55	9	0	0
	19	Math	32	47	21	0	0
	19	Reading	46	39	15	0	0
	5	Science	100	0	0	0	0
	14	ESE	50	43	7	0	0
11. I would like to be scheduled to use lab with students next year.							
Respondents=	11	English	91	9	0	0	0
	19	Math	74	26	0	0	0
	19	Reading	85	15	0	0	0
	5	Science	80	20	0	0	0
	14	ESE	86	14	0	0	0

(Table Continues)

Table 1- (Continued)

			SA	A	U	D	SD
12.I would like to be scheduled for other computer activities.							
Respondents=	11	English	63	18	18	0	0
	19	Math	18	35	18	25	6
	19	Reading	75	8	9	0	8
	5	Science	40	20	20	0	0
	14	ESE	57	36	7	0	0
13.I feel that computers provide students with important resource.							
Respondents=	11	English	82	9	9	0	0
	19	Math	69	26	5	0	0
	19	Reading	92	8	0	0	0
	5	Science	80	20	0	0	0
	14	ESE	79	21	0	0	0
14.I think that networked CAI/CMI Lab was wise use of funds.							
Respondents=	11	English	91	9	0	0	0
	19	Math	68	32	0	0	0
	19	Reading	92	8	0	0	0
	5	Science	80	20	0	0	0
	14	ESE	71	29	0	0	0
15.It is easier to use a networked lab than individual programs.							
Respondents=	11	English	73	9	18	0	0
	19	Math	53	32	11	0	0
	19	Reading	92	8	0	0	0
	5	Science	80	20	0	0	0
	14	ESE	72	21	7	0	0

Be sure to look at the written comments sections.

A summary of the written comments which were gathered is included in Appendix H.

Teachers of all subject areas were in agreement that the purchase of networked Computer Assisted Instruction hardware and software was of benefit for students and was a wise use of county funding. Some subject areas found that there was not always correlation with curriculum and classroom, however, this was not the case in the area of science. Most importantly, nearly all teachers indicated that even after a long period of time, students enjoyed coming to the CAI Lab.

Within a final survey (see Appendix F) taken at the end of the school year at the project site, teachers again were in agreement that this was a valuable resource. They also indicated that it was very important to have a person available to help in utilizing CAI Lab. Teachers were in complete agreement that they wished to use the same resources next year, with many indicating that they would like to use the CAI Lab even if they did not have the same types of students. Table 2 shows the results of this survey.

Table 2
GENERAL INFORMATION RESULTS
Single Middle School-End of the Year Questionnaire

(Results are represented in percent of respondents for each subject area.)

KEY A=Agree U=Undecided D=Disagree A U D

1. The time spent using CAI Lab is beneficial for students.

Respondents= 4	English	100	0	0
9	Math	100	0	0
7	Reading	100	0	0
5	Science	100	0	0
1	ESE	100	0	0

2. It was important to have someone available in the lab to help you by putting in students' names, to give you print-outs, etc.

Respondents= 4	English	100	0	0
9	Math	100	0	0
7	Reading	100	0	0
5	Science	100	0	0
1	ESE	100	0	0

3. If I have the same type of students next year, I wish to be scheduled in the CAI Lab.

Respondents= 4	English	100	0	0
9	Math	100	0	0
7	Reading	100	0	0
5	Science	100	0	0
1	ESE	100	0	0

4. Even if I do not have the same type of students next year, I would like to be scheduled in the CAI Lab, if possible.

Respondents= 4	English	75	25	0
9	Math	90	0	10
7	Reading	100	0	0
5	Science	100	0	0
1	ESE	100	0	0

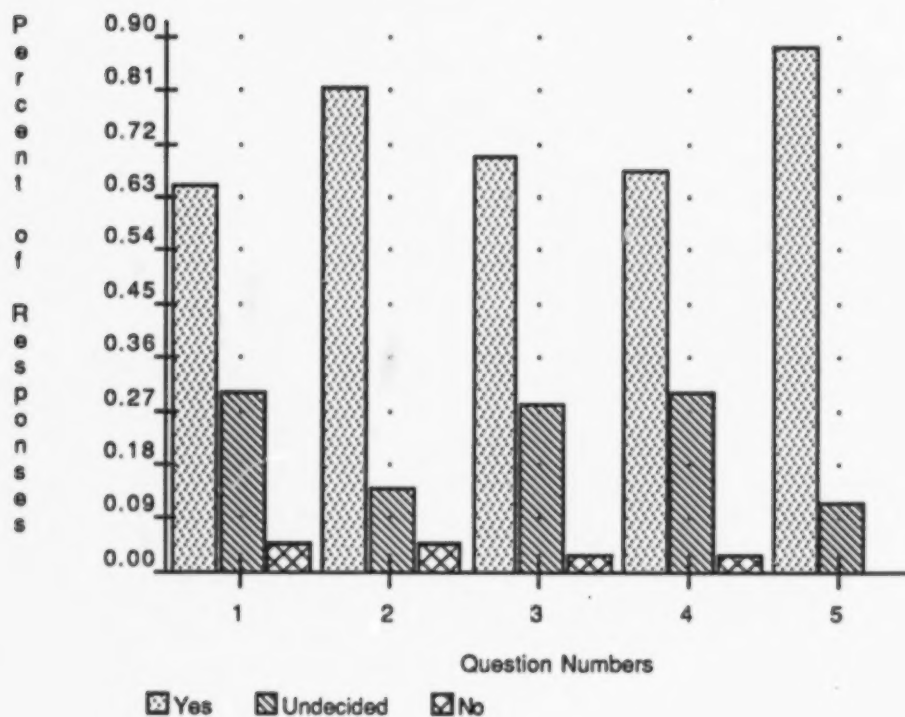
Be sure to look at the written comments sections.

Written comments may be found in Appendix H.

Teachers were scheduled into the lab as much as possible, and there were many who asked to have even more access time. A sample schedule is included in Appendix I which shows the typical two-week scheduling period for the CAI Lab. By utilizing the lab as was indicated here, there was approximately 1700 student hours logged for each month. This number is derived by accumulating time by the schedule rotating every two weeks, and by also providing extra time in the lab before school hours.

Students would often also request to come to the lab during their regular school day. They would use this time to work with special problem-solving programs or would often use the word-processing programs to work on special projects. Many of the students went on to win awards for projects in the science fair and other competitions.

A survey (see Appendix G) was given to forty-three randomly selected students. The general support of computer use by students is shown in Figure 1.

Figure 1**Student Survey on Using the CAI Lab****Questions**

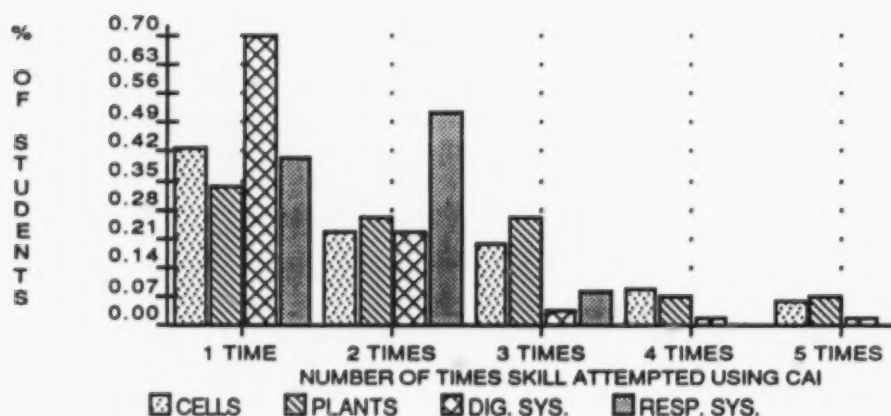
1. I think that being able to come to the CAI Lab was an important part of this class.
2. I think that it was easier to learn some things using the computers than it would be just using textbooks in class.
3. I think that learning things on the computer was made easier because I could see how I was doing immediately.
4. I liked getting the print-outs which showed me how I was doing on different parts of the computer lessons.
5. If someone gave me a choice next year, I would say that I want to come into the CAI Lab for some of my class time.

The results showed that students were very much in favor of using computers as a supplement to their usual school work. The survey also indicated that students needed to have some additional explanation about using the information on the screen as well as the print-outs. There was almost unanimous agreement that students would like to use the CAI Lab next year for some class time.

Along with the surveys, science teachers were requested to provide scores for students as they worked on a few segments which could be used for verification of Minimum Basic Skills. Students' scores were automatically saved within the managed network system, and then analyzed. A sample of the computer print-outs are included in Appendix J. The skill was requested by the teacher for students to use in the regularly scheduled CAI Lab time. Most students showed an improvement in the times needed to pass a skill on the computer. The results of these scores are provided in Figure 2.

Figure 2

STUDENT RESULTS USING
CAI FOR SCIENCE
MINIMUM BASIC SKILLS



The graph represents four objectives which were covered in seventh grade science Minimum Basic Skills. Because the managed computer system kept track of the times the skills were attempted, it was possible to see if there was any improvement over time using the CAI Lab. A

random sample was taken of 152 students who attempted various programs on the system. The results were presented in the chronological order in which the objectives were programmed for student use. Students, however, could have completed these objectives at various times, since the system was completely individualized. The graph showed a reduction in the times needed for students to complete the skills as they used the CAI Lab more. The system has the capability to be set at various passing levels, and these were set at a minimum of 70% passing rate needed to move on to another lesson or objective.

A small sampling of parents was taken along with another survey which was required by a school improvement project. Although nothing was specifically asked about the use of computers within the school, four parents voluntarily mentioned the programs as positive elements within the school. The PTSA Advisory Group also discussed the importance of the expansion of the facilities for the CAI Lab

and donated \$1200 toward the purchase of new computer hook-ups to the network. Parents were also very impressed with the variety of ways in which the computers were used by students to complete projects throughout the year. Many of the students who won top awards in the various school, county, and state level competitions completed their work at least partially through use of the computer.

Our other trial technology, use of the laser disc, was not nearly so successful. Although nearly 10 mathematics and science teachers had been given inservice training on this new mode of instruction, only 4 took part in using the laser disc within their classroom. Since there were only two laser disc players and limited software, this lack of enthusiasm may be understandable.

Unexpected results which occurred in the CAI Lab were noted in a calendar log which was kept with comments by the Computer Coordinator. First, it was very important for the teachers and students to have access to the CAI Lab in a

strictly scheduled format, because there were often random requests for use. With a Lab Manager being available this might have been possible, however, in order to be fair to all who wish to use the technology, a schedule was needed. A schedule encouraged use of the technology as well. Perhaps if a pre-scheduled time had been made for the use of the laser disc players, they would have been in more demand.

There were times when the electricity in this antiquated school building began to play havoc with the computer equipment. During these times, it was critical that there be an individual in the lab who was able to analyze, and, hopefully, rectify the situation. There often also appeared to be a large number of parents and outside visitors to the computer programs within a school. Again, there was a need for the availability of someone to explain the use of computers as instructional tools for these visitors.

The only real problems occurred within the CAI Lab when both the Lab Manager and Computer Coordinator were

out of the building at the same time. Teachers could not deal with any unexpected problems, but more importantly, some students took advantage of the circumstances. The only time that destruction of computers occurred (pulling off keys, banging on the keyboard until it was depressed, or spilling ink from pens onto the keyboard) was during the times when all students in the lab were aware that both Lab Manager and Coordinator were not in the building.

Another unexpected result of this project, which may be the most important of all, was the development of a special guide for teachers. This booklet was designed for teachers entering a new world of using the computer as an instructional tool. The work, entitled Using Networked CAI / CMI Labs. A Handbook for Teachers, is included in Appendix K. Although it began as a series of written notes scrawled on the various print-out provided by the software management companies, it developed into much more. Teachers reported that they actually had a reduction of paperwork by using the

print-outs provided by the lab. These, and other suggestions were incorporated into this guide. Ease of access to the computers resulted for both teachers and students.

Conclusions

When teachers were presented with a revolution such as the use of computers, there were several factors which needed to be addressed in order to have this technology used to it's fullest. Many conclusions about computer use were obvious from the various surveys and collection of student scores. Students and teachers wanted to use computer technology, but did not want to be bothered by the technicalities involved in the process. They appeared to latch onto the various ways in which computers can be beneficial to the instructional process, but did not want the added effort, nor did they have the needed time, to achieve these goals.

When considering the use of the CAI Lab, success was

clearly shown in this area. This was probably due to the organization which was built into the system, and the availability of a trained Lab Manager and Computer Coordinator. Teachers were not required to have special training, but were able to use the CAI Lab with another person taking the responsibilities of making sure that all of the system was operable. There was an added benefit to teachers in that they were able to reduce paperwork by using the print-outs to verify the completion of Minimum Basic Skills. Most importantly, teachers and students indicated that the use of computer technology was beneficial and fun for students.

Many other conclusions were not so obvious and have only become necessary after the requests of many teachers. The development of the CAI Lab information booklet for teachers (see Appendix K) is an example of a not so obvious result which will be very beneficial in the future. This appeared to be an item which was critical for teachers so that

they have something to guide them through the use of the CAI Lab. The written comments which were collected (see Appendix H) indicated that there were many spin-offs from the use of CAI/CMI Lab. Some of these indicated that this was a truly individualized means of delivering instruction for students. There were other subtle results such as the occurrence of cooperative learning between students, or teachers being encouraged to learn more about using computers in the classroom. Teachers of all subject areas were able to utilize computer technology, but purchases of hardware and appropriate software must be made. Even though these expenditures may be very costly at first, teachers indicated that they believed that the purchase of networked CAI Labs were a wise use of funds. Regarding the software which was available, science teachers felt that the bulk of the material was appropriate for regular and advanced students. There appeared to be a lack of adequate software for the slower students.

Perhaps the success of this program was best summarized by a teacher who was working with disruptive middle school students who had been placed in an alternative, self-contained classroom. Not only did the teacher and students stop the Coordinator in the hall to exclaim how wonderful the computers were, the teacher also wrote the following evaluation:

"The CAI/CMI Lab has been a tremendous help in planning and using the basic core curriculum for the Disruptive Drop-Out Prevention Program. Within this program there were usually 15-20 students who were 6th, 7th, and 8th graders. This was a self-contained classroom where all subject areas-math, English, reading, social studies, and science were presented. The students have, themselves, found that working on the CAI program allows them to make up class assignments, work at their own pace, practice basic skills, and find immediate, positive reinforcement for their efforts.

The CAI computers have also allowed the teacher to become better organized, identify skill areas in which students are weak, improve discipline, keep students on task, and modify disruptive behavior. The teacher has also noticed fewer students walking the hallways between classes, increased student attendance, fewer tardies to class, and

improved student attitudes toward school work.

This program is very beneficial in working with disruptive students."

The use of computers for instructional programs can be of great benefit to all students, but there must be careful thought to the planning, implementation, and continuous monitoring of the process involved.

Recommendations

If a school system or an individual school wishes to have computers as a resource for teachers and students, a large initial purchase must be made. This purchase of sufficient hardware and software must be coupled with knowledgeable personnel at each site who can monitor the use of this equipment. Since the only real complaint from teachers about using Computer Assisted Instruction was that they wished they could use this resource more, a cost-effective system should be chosen. The system should further be flexible enough to utilize presently available

computers and also expand when newer models are brought into the school. Regular computer classes may need to use this equipment for computer literacy, word processing, and other activities. The software which is presently in the school should be studied to see if an upgrade may be purchased to allow existing software to be networked.

The person or persons who are needed to make the implementation possible in most schools depends upon the size of the school and the time the teachers have for training. In most situations, a Lab Manager who would be similar to a Teacher Aide should be hired, however, after training is completed, this person should be paid more than a regular aide. There should also be another person trained and given extra technical expertise to serve as a further trouble shooter. This person may be a teacher, but should not simply be expected to carry out these duties in addition to a full teaching load. The planning, implementation, and monitoring of the use of computers is a very time consuming task and

someone who is a Computer Coordinator should be available.

Teachers should be involved in the process before any major purchases are made and throughout the process of implementation and evaluation. Again, these are the end users who are able to ascertain if the system chosen is a beneficial one, and they should have ways to impact the decisions which are made. Too often these types of decisions do not include the educators who are closest to the students. This must be an on-going process, especially in the area of purchasing additional software.

Another important goal should be the development of a guide for teachers on how to use the equipment provided. This task may be time-consuming, however, the one provided in Appendix K may be used as a template. When an inservice is given, there should be a schedule devised which encourages the use of the technology as soon as possible. By implementing immediately, perhaps teachers will not be apprehensive about the use of computers as they were with

the laser discs. If a Lab Manager and Computer Coordinator can be available for teachers to consult, increased use will also be shown.

Technology, although expensive, has been shown to enhance the educational environment of students and teachers. Computers which are used for Computer Assisted Instruction can change student attitudes about learning, and can streamline the process for teachers by reducing paperwork. The combined use of laser discs will open new horizons for all who use them. Wise schools will proceed quickly into the twenty-first century through the use of these new technological resources, and the entire educational system will benefit as a result.

Dissemination

This practicum project will be used not only by the teachers at one school site, but will be distributed to personnel in other schools who are considering the use of new

technology. Even though the topics focused on the use of these resources with middle school science students and teachers, all levels from Grades 1-12 can extrapolate from the information presented here. However, since the focus was in science, the district science coordinator will be provided with this paper. Presently, there are monies becoming available from local, state and national concerns for the expanded use of technology in education. The district's technology coordinator as well as the elementary, middle, and high school directors will be presented with this paper, and will be encouraged to share it with others.

REFERENCES

REFERENCE LIST

Aiken, R.M. (1981, March). The golden rule and ten commandments of Computer Based Instruction. T.H.E. Journal, 4(3), 58-62.

Birkhead, E. (1986, May). Installed base of LANs will skyrocket during 1986-87 school year. T.H.E. Journal, 14(4), 12-13.

Bracey, G.W. (1987, Nov./Dec.). Computer-Assisted Instruction: What the reasearch shows. Electronic Learning, 7(3), 22-23.

Forman, D. (1982, January). Search of the literature. The Computing Teacher, 2(5), 37-51.

Lehrer, A. (1988, February). A Network Primer: When is a network not a network?-First in a series of three articles. Classroom Computer Learning, 8(5), 39-47.

McCarthy, R. (1988, January). The Network Story-What's available/ How they're used. Electronic Learning, 7(4), 24-30, 62.

REFERENCE LIST (Continued)

- McDermott, C. (1987, Spring). An instructional model for supplementary computer-based skills instruction. Thrust for Educational Leadership. Los Angeles, CA: Association of California Administrators.
- Papert, S. (1980). MINDSTORMS-Children, Computers and Powerful Ideas. New York: Basic Books, Inc.
- Solomon, G. (1987, Nov./Dec.). Computers, networks and desegregation. Electronic Learning, 7(3), 14-15.
- Staff. (1986, June). A Comprehensive Educational Plan --1986-1991. The Broward Compact. (pp.7-9) Fort Lauderdale, FL: Broward County Educational Planning Center.
- Troutner, J. (1987, September). Interactive Video-Development and implementation. NASSP Curriculum Report, 17(1).

APPENDIX A
COUNTY COMPACT EXCERPTS
1986

COUNTY COMPACT EXCERPTS**1986**

Under the auspices of the Educational Planning Center, a task force was formed which included: community members, instructional personnel, parents, teachers, and students. These people gathered to form a "blue-print for the future". Included in their findings were the following items regarding the use of technology and the middle school:

1. To implement a comprehensive computerized management instructional system by June, 1991.

- A. Analyze the paperwork currently required of instructional staff and determine how CMI can assist or reduce paperwork.
- B. Conduct a CMI inservice for instructional, noninstructional, and administrative staff.
- C. Continue to update and expand CMI programs.
- D. Integrate CMI with school and district data bases.
- E. Involve teachers and curriculum specialists in determining the instructional information necessary to facilitate student articulation from school to school and from elementary to middle to high school.
- F. Develop the ability to transfer student records electronically from school to school.

2. To implement a five year plan for student computer usage by June, 1991.

... Implement an Integrated Computer Assisted Instruction (CAI) program into the total curriculum.

- A. Initiate a study of current CAI programs and techniques.
- B. Develop a plan to maximize usage of existing and future CAI equipment, including the distribution of computers beyond "labs" and into regular classrooms.
- C. Inservice instructional, paraprofessional, and administrative staff in the use of CAI and its relationship with specific curriculum.

APPENDIX B

**SUMMARY OF DATA
FROM INITIAL PILOT
OF CAI - 1985-86**

**SUMMARY OF DATA FROM INITIAL
PILOT OF CAI - 1985-86**

The following results were obtained after a limited number of teachers were able to use CAI in the 1985-86 school year.

Of those who were scheduled into the lab for math, English, & reading:

- 100% indicated that they used the lab regularly.
- 100% indicated that the time in the CAI lab was of benefit to students.
- 100% indicated that the lessons in the CAI lab complemented instruction.
- 100% indicated that their students looked forward to going to the lab.
- 100% indicated that they would like more computers available for CAI.
- 85% indicated that they wanted to use the CAI lab with all classes.
- 85% indicated that they would like to use the lab on a weekly basis.
- 42% indicated that the time spent in the lab was sufficient.
- 28% indicated that they were able to use the lab with all classes.
- 15% indicated that they would like to use the lab on a bi-weekly basis.

Of those math, English, and reading teachers who were not scheduled into the lab during the first year:

- 100% indicated that they believed that students could benefit from CAI.
- 100% indicated that the materials in the lab could benefit students.
- 75% indicated that they would like to use the CAI lab next year.

(Continued)

**SUMMARY OF DATA FROM INITIAL
PILOT OF CAI**
(Continued)

Of those teachers who had no software available to them for the first year, areas of science, social studies, Spanish, special education, art, and music responded:

86% indicated that they believed CAI would benefit students.

86% indicated that they would like software to be available in their subject area.

86% would like to use the CAI lab if software were available.

14% of teachers were art & music teachers who indicated that they did not know enough about CAI in their areas to know if it might be of benefit.

APPENDIX C
COUNTY TEACHER RESPONSES
ABOUT PILOT NETWORKED CAI LABS
1987-88

**COUNTY TEACHER RESPONSES
ABOUT PILOT NETWORKED CAI LABS
1987-88**

	AGREE	DISAGREE
There was effective use of computers in the CAI Lab.	93%	7%
Time spent in the CAI Lab was productive for students.	96%	4%
After months, students still enjoy using the lab.	92%	8%
Teachers prefer using CAI Lab than floppy disks.	85%	15%
Teachers want to have resource person in lab.	95%	5%
Curriculum appropriate for various types of students.	75%	25%
Curriculum corresponds to classroom activities. (MBS)	83%	17%
There was enough explanation given about using the lab.	73%	27%

(Continued)

**COUNTY TEACHER RESPONSES
ABOUT PILOT NETWORKED CAI LABS
1987-88
(CONTINUED)**

The County should provide time for teachers and aides to work together in learning about the system.

I would like to change the order of the programs so that the computer lessons go along with the text.

I would like input into choosing programs for the students to use.

I would like to evaluate the programs as to their difficulty for students and then replace some which are inadequate.

The teacher should have input as to where the student is placed.

We need explanations about the meaning of the print-outs which we are given.

The student reports are too time consuming to decipher. They need to be simplified.

We need a list of the programs and they should be correlated to the minimum basic skills.

We need to find a way for more students to have access to the software in the CAI lab.

I think every lab needs a lab aide so there is constantly someone there to help.

APPENDIX D

**TECHNOLOGY USE SURVEY
AND RESPONSES-BEGINNING 1988**

TECHNOLOGY USE SURVEY
AND RESPONSES-BEGINNING 1988

Please answer the following questions regarding the use of technology at this school. Answer only those that pertain to you, and return this questionnaire to Jermanovich by Wednesday. Thanks!

1. Did you get to use the computers for Computer Assisted Instruction (CAI) last year?

YES _____ NO _____

2. Would you like to be able to use the computers for CAI this year?

YES _____ NO _____

3. Would you like to have an inservice for using CAI?

YES _____ NO _____

4. Please indicate the amount of time you would like to spend learning about CAI.

1 HOUR _____ 2 HOURS _____ 3 HOURS _____

MORE _____ NONE _____

5. When would you like these offered?

BEFORE SCHOOL _____ AFTER SCHOOL _____ WORKDAYS _____

(CONTINUED)

(SURVEY CONTINUED)

6. Did you get to use the laser disc programs last year?

YES _____ NO _____

7. Would you like to be able to use them this year?

YES _____ NO _____

8. Would you like to have an inservice for using laser discs?

YES _____ NO _____

9. Please indicate the amount of time you would like to spend learning about laser discs.

1 HOUR _____ 2 HOURS _____ 3 HOURS _____

MORE _____ NONE _____

10. When would you like these offered?

BEFORE SCHOOL _____ AFTER SCHOOL _____ WORKDAYS _____

11. Do you think it is necessary to have a person designated at this school to continuously organize the use of the various types of technology?

YES _____ NO _____

12. Please list your subject area(s) _____

Comments: _____

Thanks for taking the time to do this survey

TEACHER RESPONSES
ON TECHNOLOGY USE
BEGINNING 1988

	YES	NO
Did you use computers last year for CAI?	20%	80%
Would you like to use the computers for CAI this year?	55%	45%
Would you like an inservice for using CAI?	55%	45%
Did you use laser disc technology last year?	2%	98%
Would you like to use laser discs this year?	27%	73%
Do you think it is important to have a resource person available for technology?	53%	47%

APPENDIX E

**SAMPLE OF SURVEY ON
NETWORKING - MIDDLE SCHOOLS
CAI /CMI-1988-89**

**SAMPLE OF SURVEY ON NETWORKING
MIDDLE SCHOOLS CAI/CMI - 1988-1989**

Please answer the following questions regarding your use of the networked CAI/CMI Lab in your school. Your comments at the end of this survey will be especially important. Thank you for your time.

THE KEY IS: S=STRONGLY AGREE A=AGREE U=UNDECIDED
D=DISAGREE SD=STRONGLY DISAGREE

MARK AN "X" IN THE BOX THAT INDICATES YOUR CHOICE.

SCHOOL _____ SUBJECT _____ GRADE(S) _____
SA A U D SD

1. Using the CAI Lab has been beneficial for my students. _____
2. The print-outs provided are of help to me. _____
3. The time spent in the lab was productive for students. _____
4. The computer curriculum was appropriate for me to use with my subject area and grade level. _____
5. The curriculum was appropriate for low-achieving students. _____
6. The curriculum was appropriate for regular students. _____
7. The curriculum was appropriate to use with high-achieving students. _____
8. Even after several months, students seem to consistently enjoy coming to the lab. _____
9. There has been a correlation between the computer curriculum and my class curriculum. _____
10. From the reports given, I can tell that students have shown measurable progress using the computers. _____
11. I would like to be scheduled to use the CAI/CMI Lab with students next year. _____

(SURVEY CONTINUED)

(SURVEY CONTINUED)SA A U D SD

12.I would like to be scheduled into the lab for other
computer activities-word processing, etc.

13.I feel that the use of the computers provides
students with an important additional resource.

14.I think that the networked computer lab was a
wise use of funds.

15.It is easier to use a networked lab than
individual stand-alone programs.

Please give any additional information on the types of classes which
you brought to the CAI/CMI Lab. (Drop-out Prevention, Chapter I, etc.)

THE FOLLOWING COMMENTS ARE VERY IMPORTANT!

Do not write your name. This is to be completely
anonymous.

Look back at the way you answered your questionnaire and please
respond in the following space. We are especially interested in why
you marked some answers negatively, and any suggestions about the
CAI Labs including relevant curriculum analysis. (Use additional
pages if necessary.)

What do you like best about the lab?

What do you like least about the lab?

(How would you change it for the better?)

Please relate interesting experiences using the lab.

PLEASE RETURN THIS TO YOUR COMPUTER CONTACT PERSON.
THANK YOU FOR YOUR TIME!

APPENDIX F

**SAMPLE SURVEY OF
NETWORKING LABS FROM
SINGLE MIDDLE SCHOOL USING
CAI /CMI**

**SAMPLE SURVEY OF NETWORKING LABS
FROM SINGLE MIDDLE SCHOOL USING
CAI / CMI**

Name _____
Class(es) _____
Subject(s) _____

Please answer these questions regarding the use of the CAI Lab.
 Your answers will be kept and used to plan for next year's
 program.

1. Do you feel that the time which students spent in the CAI Lab
 was beneficial for them? _____

2. Did you feel that it was important to have someone available in
 the lab to help you by putting in students' names, give you print-
 outs, etc.

3. If you have the same type of students next year, do you wish to
 be scheduled in the CAI Lab?

4. Even if you do not have the same type of students next year,
 would you like to be scheduled in the CAI Lab if possible?

5. We need to have some information on the types of activities or
 programs which you felt were especially helpful to students.
 Please also indicate why you feel that way.

6. Please tell us of any happenings which may be indicative of
 how students feel about using the CAI Lab.

APPENDIX G

**STUDENT SURVEY ON
USING THE CAI LAB**

STUDENT SURVEY
on using
COMPUTER ASSISTED INSTRUCTION (CAI)
LAB 1988-89

The following information will be used to decide how the CAI Lab will be used for students next year. Please take your time and think about your answer before circling the most nearly correct response.

1. I think that being able to come to the CAI Lab was an important part of this class.

A. YES B. UNDECIDED C. NO

2. I think that it was easier to learn some things using the computers than it would be just using textbooks in class.

A. YES B. UNDECIDED C. NO

3. I think that learning things on the computer was made easier because I could see how I was doing immediately.

A. YES B. UNDECIDED C. NO

4. I liked getting the print-outs which showed me how I was doing on different parts of the computer lessons.

A. YES B. UNDECIDED C. NO

5. If someone gave me a choice next year, I would say that I want to come into the CAI Lab for some of my class time.

A. YES B. UNDECIDED C. NO

Thank you for taking the time to complete this
questionnaire.

APPENDIX H

**GENERAL WRITTEN COMMENTS
FROM TEACHERS USING
NETWORKED CAI / CMI**

General Written Comments
from teachers using
networked CAI / CMI

COMMENT

Used with PPP (MBS) skills as a means of passing students
 Used as reinforcement for skills and classroom activities
 Students looked forward to going into CAI Lab with great anticipation
 The students enjoy working with the computers
 Students are able to work at their own pace- Truly individualized
 Students are always well behaved in the lab- often much better than class
 Students enjoy finding out how they are doing immediately- get rewarded
 It is very important that there be a full time aide (Lab Manager) in the CAI Lab
 The reading programs were excellent.
 Some reading programs were too repetitious or at too high a level
 It would be nice to have more practice skills on each level.
 Word processing programs were very beneficial to all students
 Bilingual students benefited from the reading programs
 Average students can benefit from the use of CAI Lab
 Print-outs given were especially helpful, and students enjoyed getting them
 Math programs were presented in a progressive continuum and were beneficial
 Some math programs did not address the SSAT and MBS-
 or had minor problems which need to be changed
 Students especially liked the problem solving (logic) programs
 The English programs were excellent
 The science programs allowed students to approach science in a new way
 There was increased attendance when use of computers started (Drop-outs)
 Need to be able to come to lab more often- and/or- have more computers
 It is not good if CAI Lab is closed for other activities
 Need to have hook-up to system in my classroom
 Need a special program for ESE students- some programs to high a level
 Need to provide a manual for teachers including sequence of materials-
 Correlations of skills w/in print-outs
 Offers another avenue for learning
 This has encouraged me to learn more about how to use computers in the classroom
 Need to have additional subject areas (Levels) available for all students
 Since teacher stays in lab, can see individual problems of students more easily
 Need a larger room (more space bet. students) -
 A.C. does not regulate well or goes off- Some power problems
 Cooperative learning goes on, students learn from each other

APPENDIX I

**SAMPLE SCHEDULE
TWO-WEEKS IN A MIDDLE SCHOOL
NETWORKED CAI / CMI LAB**

**SAMPLE SCHEDULE
TWO-WEEKS IN A MIDDLE SCHOOL
NETWORKED CAI / CMI LAB**

2 Apr - 15 Apr 1989

Typical Example of Rotation of Classes through CAI LAB

Apr 3 - Monday 1 SCIENCE-8 / READING 2 READING / READING 3 READING / READING 4 READING / READING 5 READING / READING 6 READING / READING	Apr 10 - Monday 1 READING / READING 2 MATH / READING 3 READING / READING 4 READING / READING 5 READING / READING 6 READING / READING
Apr 4 - Tuesday 1 MATH / ENGLISH 2 READING / ENGLISH 3 READING / ENGLISH 4 SCIENCE-6 / ENGLISH 5 READING / ENGLISH 6 READING / ENGLISH	Apr 11 - Tuesday 1 MATH / ENGLISH 2 MATH / ENGLISH 3 MATH / ENGLISH 4 MATH / ENGLISH 5 READING / ENGLISH 6 READING / ENGLISH
Apr 5 - Wednesday 1 SCIENCE-7 / READING 2 SCIENCE-7 / READING 3 SCIENCE-7 / MATH 4 SCIENCE-7 / MATH 5 SCIENCE-7 / READING 6 SCIENCE-7 / ENGLISH	Apr 12 - Wednesday 1 SCIENCE-7 / READING 2 SCIENCE-7 / READING 3 SCIENCE-7 / MATH 4 SCIENCE-7 / MATH 5 SCIENCE-7 / READING 6 SCIENCE-7 / ENGLISH
Apr 6 - Thursday 1 READING / ENGLISH 2 MATH / ENGLISH 3 READING / ENGLISH 4 MATH / ENGLISH 5 MATH / ENGLISH 6 MATH / ENGLISH	Apr 13 - Thursday 1 READING / ENGLISH 2 MATH / ENGLISH 3 READING / ENGLISH 4 MATH / ENGLISH 5 MATH / ENGLISH 6 MATH / ENGLISH
Apr 7 - Friday 1 MATH / READING 2 MATH / READING 3 MATH / READING 4 MATH / READING 5 READING / READING 6 READING / READING	Apr 14 - Friday 1 MATH / READING 2 MATH / READING 3 MATH / READING 4 MATH / READING 5 READING / READING 6 READING / READING

Rotation is repeated every two weeks.

APPENDIX J
SAMPLE PRINT-OUT OF STUDENT SCORES
AS RECORDED
IN THE CAI / CMI LAB

**SAMPLE PRINT-OUT OF STUDENT SCORES
AS RECORDED
IN THE CAI / CMI LAB**

ENGLISH MINIMUM BASIC SKILLS (6)

Student #	Student	Name			
DATE	OBJ	LN	LESSON NAME	SCORE	%
11/1	1	1	IDENT. COMM. NOUN	17/17	100
11/1	1	2	TYPES OF PROP.NOUN	12/15	80
11/1	2	1	SING.VERB AGREEMT	17/19	89
11/15	5	1	FIRST WORD.SENTEN.	10/12	88
11/15	5	2	PROP.PERS.NAMES	10/10	100
11/15	7	1	GO-WENT-GONE	18/20	90
12/1	7	2	EAT-ATE-EATEN	15/20	75
TOT.LESSON(S) COMPLETED, TOT.OBJECTIVE(S) MASTERED					
SCORE OF RIGHT/TOTAL FOR PERCENT. TIME ON SYS=--MIN					

SCIENCE MINIMUM BASIC SKILLS (7)

Student #	Student	Name			
DATE	OBJ	LN	LESSON NAME	SCORE	%
3/21	6	1	BONES (TUTORIAL)	1/1	100
3/21	6	2	FIND MISSING BONES	1/1	100
4/12	7	1	DIGESTIVE SYS.	9/11	81
4/27	7	2	RESPIRATORY SYS.	10/12	83
4/27	7	3	CIRCULATORY SIM.	5/5	100
4/27	7	4	SKELETAL SYS.	5/5	100
4/27	7	5	MUSCULAR SYS.	5/6	83
TOT.LESSON(S) COMPLETED, TOT.OBJECTIVE(S) MASTERED					
SCORE OF RIGHT/TOTAL FOR PERCENT. TIME ON SYS=--MIN					

APPENDIX K

**USING NETWORKED CAI / CMI LABS
A HANDBOOK FOR TEACHERS**

USING
NETWORKED
CAI / CMI Labs
A Handbook for Teachers

prepared by:
Trudy Jermanovich
Computer Coordinator
Sunrise Middle School

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Many thanks to all teachers and staff of
Sunrise Middle School for their unending patience
in experimental use of networked computers
for enhancing instruction.

*And special thanks to the
following persons
for suggestions
and editorial comments:*

Ms. Barbara Cymalo-Lab Manager

Teachers:

Mr. Paul Boggess

Ms. Val Emery

Ms. Gladis Johnson

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Using Computer Networking

BACKGROUND and PURPOSE

Background

For the past several years, Sunrise Middle School has been in the process of providing networked Computer Assisted Instruction (CAI) for many students. This project was initially provided through funds which were raised by the combined efforts of parents, students, teachers, and community members. The lab was expanded by receiving grant monies and with additional support provided by special programs such as Chapter I and Drop-Out Prevention. The project has been so successful that this type of program is being proposed for all schools in our district.

Purpose

The purpose of this booklet is to provide a comprehensive guide for teachers who will be utilizing this important instructional resource. It is intended to acquaint the novice with information about CAI, and also to act as a reference for teachers who have previously used the CAI Lab. *A note regarding semantics*--Experienced teachers may feel somewhat uncomfortable with "his" and "her" being used interchangeably within this booklet. Many newly written textbooks are suggesting this method of writing in order to minimize sexual stereotyping. An attempt was made to vary the use of these pronouns here. Please do not be bothered by this intentional change in gender.

The content of this booklet may be modified if teachers find flaws in certain portions, or when there are changes in the way that the CAI program is organized. Feel free to make notes and give any suggestions to the Computer Coordinator.

GENERAL INTRODUCTION

Networked Computer Systems

Networking is the connecting of a large number of computers to one data source. This enables any Apple II series computer that has the correct card placed in slot 7 to hook into the same programs without any disks being used. Selected software programs which have previously been placed on the storage device (hard drive) can be accessed by each computer. Our hardware was developed by Corvus Systems and is referred to as a Corvus Network. (See Appendix A) We have a variety of ways in which teachers can use this system. The programs are organized into two sections on the hard drive which are said to have managed and unmanaged software.

Managed Software (General Description)

Managed software makes the use of the computer for CAI (Computer Assisted Instruction) / CMI (Computer Managed Instruction) a reality for all teachers. Under a management system, software programs provide a more complete means of using computers, networked, or not. The Lab Manager can do all that is necessary to make the use of these programs very easy for both students and teachers. The names of the students are first entered into the system by the Lab Manager, along with other information such as grade level, student number, sex, and race. Teachers then choose which objectives they would like an entire class or individual students to use when they come into the lab. The lab manager must assign these students to the correct objectives as directed by the teacher. When the students come into the lab, they need only enter the correct section of the hard drive and give their name, grade, and student

number. A special section of the management program will keep track of the progress of each of the students as they work individually on their computer. Paper work is reduced for the teacher since easily readable print-outs can be provided for each student. Minimum Basic Skills (MBS) are no longer difficult to pass, since this can be done via the computer. Both teachers and students are able to use classroom time more effectively.

Two companies have provided managed programs for our students: (For company addresses-See Appendix A)

****COMPUTER NETWORKING SPECIALISTS** provides programs under the entrance name of "CW". This is what the student or teacher types when first entering the lab if the screen says: "Enter your Account Name_____". We presently have programs for all 6th, 7th, and 8th graders in the areas of mathematics, English, reading, and science. Many of our Drop-Out Prevention, Chapter I, and regular students use these programs. We will also have some experimental programs for social studies and ESOL students.

****IDEAL LEARNING CORPORATION** provides some higher level programs in the areas of writing skills, Spanish, and algebra. A student can enter this program by typing "IDEAL" when first entering the lab if the screen says: "Enter your Account Name_____".

The teacher must designate which companies' program, objective(s), and lesson(s) they wish to have students use well before the students are scheduled to come to the lab. It is recommended that information be given to the Lab Manager at least one week in advance.

Unmanaged Software (General Description)

Unmanaged software is placed on the networking system in a menu-driven format. This allows teachers or students in a lab or out in a classroom to easily access

programs without being a "Floppy Disk Jockey". The programs have been transferred from the individual disks to the hard disk drive, and are simply waiting to be called up through the menu system. This is particularly beneficial when there is only one computer in the room, or if the teacher wishes the students to have a break from the regular managed programs.

These menu programs do not have the capability to have scores saved on the hard drive. No print-outs can be received on the work that students do under the menu system.

Some of these programs may be the same as the ones on the managed system, but many are different. Teachers may also use these programs for demonstration purposes with the entire class, if she has her computer hooked up to a color television. Another use for computing in the lab or in the classroom is for word-processing to be used in writing assignments or projects. On our system we have Appleworks and now also have Magic Slate in 20, 40 or 80 column. Even older Apple II+'s that are out in the classroom can be used for programs on the menu and word processing programs. Software is usually put on a menu by subject area, but there are some special programs which cannot be classified in this way. They are put under the titles of Problem-Solving Skills and Miscellaneous Programs. These programs are very popular with teachers and students as they provide for practice skills which are necessary for all subject areas, and yet they are presented in formats which are structured so that students feel like they are playing games. Students can sometimes spend hours and not work out a puzzle, and yet they are formulating strategies for organizing, investigating, manipulating, and trying alternate ideas and plans of attack. This is problem-solving in it's truest sense.

ENTRANCE INTO THE NETWORKED SYSTEM

Before the first class arrives each day, the Lab Manager must have turned on the hard drive system. This should always be done with all computers and monitors which are networked turned off. This needs to be done because there might be an electrical surge down the wires as the hard drives are coming up to speed. The hard drives are kept in a locked closet which students should not enter. These drives are the most sensitive and expensive parts of the system. They contain what is called a "server" as well as a storage place for the programs. All information is stored on these drives. This includes data which is received about students, as well as the programs which they use. Other programs may also be stored separately on the hard disk, and, if you wish, even different computers such as IBM or Macintosh computers may be used. The way you enter the system depends on which types of programs you wish to use.

Managed Programs

If you wish to use the types of programs which we have that are "managed", you will first enter the name given to that program.

This would be typed in when the screen says:

"Enter your account name:_____"

The user would type a name and then press return.

If you wish the student to use CNS programs, they type CW and then return. (This stands for ClassWorks.)

If you wish the students to use the IDEAL programs, they type IDEAL and then return.

Both of these programs will ask for the student name and number, and the instructions must be followed exactly as asked. (Last Name, First Name-etc.)

Remember, as the students use these programs, their scores will be saved and the teacher will be provided with a print-out. These programs are the ones which the teacher will have previously told the Lab Manager to enter for his students. The students will soon find that they can also view their scores as they work on the managed programs. Students should be told that the scores which they receive while working on the computer will be entered as a grade for them. They are then very serious about doing the best they can while in the computer lab.

Unmanaged (Menu) Programs

These are the programs which will not have a score saved for each student. Teachers should be aware, however, that they can easily have students keep their own score sheet which can indicate how they did on a particular program. Students may also take notes on the important points which are presented, or other assignments as they use the programs. This will keep the student more focused, and will give the teacher an indication of how much was accomplished. Students often like to use paper and pencil anyway to work out math problems, or write down notes on parts of the problem-solving programs.

If you wish to use the types of programs which we have that are "unmanaged", you will first enter the word MENU which has been organized and assigned with that title.

This would be typed in when the screen says: "Enter your account name:_____". The user would type MENU and then press return. Once the MENU appears, the student types in the number which is next to the programs he or she will use and then they will press return. On our MENU, number 5 contains Problem Solving Skills and number 7 contains Miscellaneous Programs such as Study Skills. These are sections that can easily be used by all students.

Remember, when a student is using the MENU programs, there will be no data saved on how he or she is doing. These may be thought of as stand-alone programs which are not managed.

The third type of program which may be used by teachers and students are called application programs. We presently have two programs in this category, but may add more in the future.

The first program is called Appleworks which has three parts to it, a word processor, a data base, and a spreadsheet. If you or your students have had training in using this program, you enter it through the system by typing in AW and pressing return.

The second program is a word processing program that is very easy to use and students may have had training with this program in elementary school. The program is called Magic Slate, and students enter the program by typing MAGIC and pressing return.

The word processing programs can be very helpful for students when they are given a writing assignment. The teacher will need to arrange to have data disks available so that students can store what they have written. Later teachers will need to check the files, print-out students' work, or have someone print out the work. There can be special instructions given on what the easiest methods are for using these types of programs, if requests are made through the Computer Coordinator.

USING THE RESOURCES AVAILABLE

Bringing a Class to the CAI Lab

Generally, students are very anxious to come into the lab, and show improved behavior in order to be able to use this resource. (See teacher comments list) There should, however, be some ground rules which are set before students arrive. They should wait at the door for all to enter together, *after* the teacher enters the lab. Sometimes it is best to have the Lab Manager or the teacher seat the students at the computers. In this way, students may not sit next to someone they know and become distracted from their work. In other instances, the teacher may want the students to work together or help one another in cooperative learning efforts. In these cases, they should be cautioned to keep their voices down so that others will not be disturbed. Usually, students will be working independently on managed software which will provide for reinforcement and remediation of Minimum Basic Skills. The teacher should have chosen the appropriate lessons either for the class or for individual students prior to bringing the students to the lab. Table 1 shows a sample format of how the objectives and lessons may appear on a print-out from our system. Teachers must only be concerned with the Objective Numbers and Lesson Titles. This is how Minimum Basic Skills have been or can be correlated.

Although Table 1 has been set up with objectives from the science curricula, any subject area which has this type of managed program would have a similar structure. It is important that the teacher look at the objectives and lesson titles carefully and decide which ones they would like to use with their students. Until the teacher has been in the lab with a class, it may be difficult to tell if the software is appropriate for that level, but in most cases other teachers will have already done some preliminary analysis.

TABLE 1
SAMPLE FORMAT OF
OBJECTIVES WITH LESSONS
 Assignment Sequence # 10
 SCIENCE
 Updated: 1/5/89

No.	Objective / Lesson Title	Program
3 EA	GREEN PLANTS	
	1 PARTS OF GREEN PLANTS	872
	2 FOOD CHAINS AND PYRAMIDS	872
	3 FLOWERS AND REPRODUCTION	872
	4 PLANTS FROM PARTS	872
4 EA	CELLS AND TISSUES	
	1 THE STRUCTURE OF CELLS	873
	2 BINARY FISSION	873
	3 FROM CELLS TO TISSUES	873
5 EA	INTRODUCTION TO BIOCHEMISTRY	
	1 UNDERSTANDING ATOMS	874
	2 NATURE OF COMPOUNDS	874
	3 CARBOHYDRATES	874
	4 PROTEINS	874
	5 FATS	874
7 EA	THE HUMAN BODY 1 & 2	
	1 THE DIGESTIVE SYSTEM	876
	2 THE RESPIRATORY SYSTEM	876
	3 A CIRCULATORY SIMULATION	876
	4 THE SKELETAL SYSTEM	876
	5 THE MUSCULAR SYSTEM	876
	6 THE NERVOUS SYSTEM	876
8 EA	EARTH SCIENCE: INSIDE STORY	
	1 INSIDE THE EARTH	880
	2 PLATE TECTONICS	880
	3 SWEEPING THE OCEAN FLOOR	880
	4 FIRE AND BRIMSTONE	880
	5 THE OTHER SIDE OF THE MNT	880
12	THE STRUCTURE OF MATTER	
	1 ATOMS AND MOLECULES	892
	2 THE STATES OF MATTER	892
	3 PHYSICAL AND CHEMICAL CHG	892

The Objective Numbers and Lesson Titles shown in Table 1 contain topics studied in 6th, 7th and 8th grade science classes. If a teacher was teaching 6th grade science she would request *Objective Number 8-Earth Science: The Inside Story*. A choice could be made for all or part of the five *Lessons* which are available under this objective. If a seventh grade teacher were scheduled into the lab, one time he might request *Objective Number 3-Green Plants* with one or more of the four *Lessons*. Later in the year he might request *Objective Number 7-The Human Body 1 & 2*. He might request all or part of the six available *Lessons*. In eighth grade science, when studying basic principals of chemistry, the teacher may first choose *Objective Number 12-The Structure of Matter*, with all or part of the *Lessons*. She may also choose *Objective Number 5-Introduction to Biochemistry*. In this manner teachers may relate some of the topics in chemistry to the topics studied in seventh grade life science about the human body. Here is a sample form which can be sent to the CAI Lab Manager at least one week prior to bringing a class to the lab:

Teacher_____		Period(s)___
Subject_____		Date Scheduled:_____
Grade Level_____		
Objective Number and Title:		

Lesson Number(s):		

___All Students		___Individual Students (List Name/Student #)

(See Appendix B for additional copies)

It is necessary to send this form to the CAI Lab Manager at least one week prior to bringing a class to the lab because she must enter this information into the managed system. After your students have come into the lab and completed these lessons, you will receive a print-out which indicates how much work has been completed. These results will be printed by the Lab Manager and placed in your mailbox. She normally attends to this task once a week, however, if you have a parent conference or if a child is leaving, you may request a cumulative report at any time.

A sample form is included here so you understand what information is needed for this report.

Teacher_____
Subject_____ Grade Level_____ Period_____
Student Name_____
Student Number_____

(See Appendix B for more copies)

You would usually need similar information for *new* students placed in your class. For these students you will also be asked to include their sex and race. You may either send this information to the lab early, or the Lab Manager can place the student into the system while your class is in the lab. If the Lab Manager is not present and you have new students, they can either join another member of the class for that session, or you may choose to have them use programs which are on the menu system.

Understanding the Reports

The reports which are generated by the managed systems have been used by teachers in a variety of ways. The most beneficial seems to have been to verify that certain skills have been passed by students. The reports contain the teacher's name, subject and class period; the student's name and number; the dates they used the system; and individual scores with each *Objective* and *Lesson*. After the list is generated, there is a summary at the bottom which contains information on *Lessons* completed, the *Objectives* mastered, the overall average score by item and by percent, and the total time on the system. Table 2 contains some examples of the way a print-out would look for two subject areas:

TABLE 2
SAMPLE STUDENT PRINT-OUTS

Student	#--Student	Name			
DATE	OBJ	LN	LESSON NAME	SCORE	%
11/1	1	1	IDENT. COMM. NOUN	17/17	100
11/1	1	2	TYPES OF PROP. NOUN	12/15	80
11/1	2	1	SING. VERB AGREEMENT	17/19	89
11/15	5	1	FIRST WORD SENTENCE	10/12	88
11/15	5	2	PROP. PERS. NAMES	10/10	100
11/15	7	1	GO-WENT-GONE	18/20	90
12/1	7	2	EAT-ATE-EATEN	15/20	75
TOT. LESSON(S) COMPLETED, TOT. OBJECTIVE(S) MASTERED					
SCORE OF RIGHT/TOTAL FOR PERCENT. TIME ON SYS--MIN					

Student	#--Student	Name			
DATE	OBJ	LN	LESSON NAME	SCORE	%
3/21	6	1	BONES (TUTORIAL)	1/1	100
3/21	6	2	FIND MISSING BONES	1/1	100
4/12	7	1	DIGESTIVE SYS.	9/11	81
4/27	7	2	RESPIRATORY SYS.	10/12	83
4/27	7	3	CIRCULATORY SIM.	5/5	100
4/27	7	4	SKELETAL SYS.	5/5	100
4/27	7	5	MUSCULAR SYS.	5/6	83
TOT. LESSON(S) COMPLETED, TOT. OBJECTIVE(S) MASTERED					
SCORE OF RIGHT/TOTAL FOR PERCENT. TIME ON SYS--MIN					

Reading the Results

The results of the reports contain a variety of information which each teacher uses in the way that is most appropriate for his classes. The most common use is to correlate the *lessons* with the minimum basic skills and use the time in the CAI Lab to help students pass these skills. There has also been evidence (through increased test scores) that this type of reinforcement may help students increase their scores on the Florida State Student Assessment Test (SSAT), and the IOWA Test of Basic Skills (IOWA).

It is best if you use the results to give the student a grade for the time spent in the CAI Lab. This will encourage concentrated effort and the students will be more concerned about their scores. You may decide to give a daily grade for the *objectives* and *lessons* successfully completed, and then an overall grade when you ask for a summary of all scores at the end of a grading period. Many teachers lower a student's grade if it is necessary for them to repeat a *lesson*, but this depends upon your students. The system has been set to allow students to pass a *lesson* only when they receive a score of 70%. This can be modified if all teachers in the school decide this score should be raised or lowered. It will not affect the score or percent, but will simply repeat the *lesson* until the student passes. Sometimes the student will be asked by the computer to "*Call your teacher!*". This means that he or she has missed the objective several times and probably needs your assistance.

Don't forget that there are other types of programs (Menu Programs or Word Processing Programs) which may be used with students, and many can be quite beneficial for supplementing the curriculum.

Results of CAI/CMI Surveys

For the past several years our school and others have used Computer Assisted Instruction with students. With all surveys given, teachers have felt that this is a very beneficial way to reinforce skills and to provide students with an alternate means of receiving instruction. Each year, also, teachers request to use the CAI Lab for the next school year, and usually wish to come to the lab more frequently or with more of their students.

Because the lab is in such demand, it is critical that teachers bring their classes at the assigned times. Schedules are made and each teacher is provided with one at the beginning of each month. Normally you would be scheduled in the lab every two weeks with a class, but sometimes special events interfere with the normal routine. Make sure that you make your students aware of the time you are scheduled, and they will certainly remind you if you forget. Table 3 shows the classes which were scheduled to use the CAI Lab in the 1988-89 school year. Approximately 1700 students have had access to the lab twice a month.

TABLE 3
Summary of Classes Using CAI/CMI
1988-89 SCHOOL YEAR

ENGLISH	-	14	Classes
MATH	-	26	Classes
READING	-	23	Classes
SCIENCE	-	14	Classes

These classes included Chapter I (Remedial), Regular and Advanced, Drop-Out Prevention (VIP) and a few SLD students. Because of successes shown throughout the county, and because of special funding, these students should continue to be targeted to use the CAI Lab in the future.

A sample schedule is provided in Table 4.

TABLE 4
SAMPLE TWO-WEEK SCHEDULE

2 Apr - 15 Apr 1989

Typical Example of Rotation of Classes through CAL LAB

Apr 3 - Monday 1 SCIENCE-8 / READING 2 READING / READING 3 READING / READING 4 READING / READING 5 READING / READING 6 READING / READING	Apr 10 - Monday 1 READING / READING 2 MATH / READING 3 READING / READING 4 READING / READING 5 READING / READING 6 READING / READING
Apr 4 - Tuesday 1 MATH / ENGLISH 2 READING / ENGLISH 3 READING / ENGLISH 4 SCIENCE-6 / ENGLISH 5 READING / ENGLISH 6 READING / ENGLISH	Apr 11 - Tuesday 1 MATH / ENGLISH 2 MATH / ENGLISH 3 MATH / ENGLISH 4 MATH / ENGLISH 5 READING / ENGLISH 6 READING / ENGLISH
Apr 5 - Wednesday 1 SCIENCE-7 / READING 2 SCIENCE-7 / READING 3 SCIENCE-7 / MATH 4 SCIENCE-7 / MATH 5 SCIENCE-7 / READING 6 SCIENCE-7 / ENGLISH	Apr 12 - Wednesday 1 SCIENCE-7 / READING 2 SCIENCE-7 / READING 3 SCIENCE-7 / MATH 4 SCIENCE-7 / MATH 5 SCIENCE-7 / READING 6 SCIENCE-7 / ENGLISH
Apr 6 - Thursday 1 READING / ENGLISH 2 MATH / ENGLISH 3 READING / ENGLISH 4 MATH / ENGLISH 5 MATH / ENGLISH 6 MATH / ENGLISH	Apr 13 - Thursday 1 READING / ENGLISH 2 MATH / ENGLISH 3 READING / ENGLISH 4 MATH / ENGLISH 5 MATH / ENGLISH 6 MATH / ENGLISH
Apr 7 - Friday 1 MATH / READING 2 MATH / READING 3 MATH / READING 4 MATH / READING 5 READING / READING 6 READING / READING	Apr 14 - Friday 1 MATH / READING 2 MATH / READING 3 MATH / READING 4 MATH / READING 5 READING / READING 6 READING / READING

Rotation is repeated every two weeks.

CONCLUSIONS

Over the years, several reports have been compiled which show the validity of using computers to enhance student achievement and provide a valuable supplement for instruction. Many of these reports are available upon request if teachers need this information for papers or projects. Generally, throughout the county, teachers overwhelmingly felt that using networked CAI/CMI was beneficial to the students, that students had improved behavior, had raised their skill levels, and had shown measurable progress. One hundred percent of the teachers indicated that they would like to be scheduled into the CAI Lab next year, and that this purchase had been a wise use of funds.

Most importantly, teachers indicated that students looked forward to coming to the CAI Lab and working with computers. The following summarize the most common comments written by teachers: (See Appendix C for additional comments.)

- 1) That students look forward to going into the CAI Lab with great anticipation -
- 2) That students enjoy working with the computers -
- 3) That students are able to work at their own pace in a truly individualized manner -
- 4) That students are always well behaved in the lab-often much better than in class -
- 5) That students enjoy the immediate feed-back (reward) which they receive -
- 6) That teachers find that the print-outs were helpful and that students enjoyed getting them -
- 7) That using computers offer another avenue for learning, especially for skills and reinforcement-
- 8) That teachers felt that programs should be available for all levels of students -
- 9) That a full time lab aide (manager) was very important for the smooth running of the CAI Lab -
- 10) That they wish they could come to the lab more often -

We, who have used the CAI/CMI Lab in the past, are sure you will join our ranks in agreeing that computer use has come of age as an important instructional resource for the students of today.

Appendix A (within APPENDIX K)
Company Names & Addresses

COMPANY NAMES & ADDRESSES**PRODUCT****INFORMATION****Appleworks**

Claris Corporation
440 Clyde Avenue
Mountain View, CA 94043
1-800-3-CLARIS ext.160

**Classworks
Managed Software**

Computer Networking
Specialists
Route 1, Box 286-C
Walla Walla, WA 99362
1-800-372-3277

Hardware

Corvus Education
Division of Control Data
8800 Queen Ave. S.
Bloomington, MN 55431
1-800-451-2186

**Ideal
Managed Software**

Ideal Learning Corporation
327 S. Marschall Rd.
Shakopee, MN 55379
(612) 445-2690

Magic Slate

Sunburst Communications
39 Washington Ave.
Pleasantville, NY 10570
1-800-221-5912

**Unmanaged
Software**

Most software companies
list these programs under:
Corvus Network Version

Appendix B (within APPENDIX K)

FORMS:

Entering Objectives & Lessons

Requesting a Print-Out on a Student

Requesting a New Student be Entered

Forms for Entering Objectives and Lessons

These forms should be sent to Room 45 at least one week prior to bringing students to the CAI Lab. Copies will be available in the lab.

Teacher_____		Period(s)___
Subject_____	Date Scheduled:_____	
Grade Level_____		
Objective Number and Title: _____		
Lesson Number(s): _____		
___All Students		___Individual Students (List Name/Student #)

Teacher_____		Period(s)___
Subject_____	Date Scheduled:_____	
Grade Level_____		
Objective Number and Title: _____		
Lesson Number(s): _____		
___All Students		___Individual Students (List Name/Student #)

**Forms for Requesting
a Print-Out on a Student**

These forms should be sent to Room 45 when a separate copy of the student's scores are needed. Copies will be available in the lab.

Teacher_____
Subject_____ Grade Level_____ Period____
Student Name_____
Student Number_____

Teacher_____
Subject_____ Grade Level_____ Period____
Student Name_____
Student Number_____

Forms for Requesting
a New Student be Placed on the System

These forms should be sent to Room 45 when a new student enters your class. You may prefer to have the student entered next time you come to the CAI Lab.

Copies will be available in the lab.

Teacher_____		
Subject_____	Grade Level_____	Period____
Student Name_____		
	Sex_____	
Student Number_____	Race_____	

Teacher_____		
Subject_____	Grade Level_____	Period____
Student Name_____		
	Sex_____	
Student Number_____	Race_____	

**Appendix C (within APPENDIX K)
Final Written Comments by Teachers**

Final Written Comments
from teachers using
networked CAI / CMI

COMMENT

Used with PPP (MBS) skills as a means of passing students
 Used as reinforcement for skills and classroom activities
 Students looked forward to going into CAI Lab with great anticipation
 The students enjoy working with the computers
 Students are able to work at their own pace- Truly individualized
 Students are always well behaved in the lab- often much better than class
 Students enjoy finding out how they are doing immediately- get rewarded
 It is very important that there be a full time aide (Lab Manager) in the CAI Lab
 The reading programs were excellent.
 Some reading programs were too repetitious or at too high a level
 It would be nice to have more practice skills on each level.
 Word processing programs were very beneficial to all students
 Bilingual students benefited from the reading programs
 Average students can benefit from the use of CAI Lab
 Print-outs given were especially helpful, and students enjoyed getting them
 Math programs were presented in a progressive continuum and were beneficial
 Some math programs did not address the SSAT and MBS-
 or had minor problems which need to be changed
 Students especially liked the problem solving (logic) programs
 The English programs were excellent
 The science programs allowed students to approach science in a new way
 There was increased attendance when use of computers started (Drop-outs)
 Need to be able to come to lab more often- and/or- have more computers
 It is not good if CAI Lab is closed for other activities
 Need to have hook-up to system in my classroom
 Need a special program for ESE students- some programs to high a level
 Need to provide a manual for teachers including sequence of materials-
 Correlations of skills w/in print-outs
 Offers another avenue for learning
 This has encouraged me to learn more about how to use computers in the classroom
 Need to have additional subject areas (Levels) available for all students
 Since teacher stays in lab, can see individual problems of students more easily
 Need a larger room (more space bet. students) -
 A.C. does not regulate well or goes off- Some power problems
 Cooperative learning goes on, students learn from each other